

### **Introduction:**

I am Myra O'Canna, archivist for Sandia National Laboratories. It's a pleasure to be here today to speak to your class about institutional culture and how it applies to Sandia National Laboratories. This is especially fun for me to be here because I'm an alumnus of UNM. I graduated twenty-five years ago with a Bachelor of Arts degree, majoring in Psychology and Anthropology and this degree has certainly served me well all these years - even helping me to become the Sandia Archivist. I have been an Archivist for five years and recently became certified by the Academy of Certified Archivists.

### **So, I am an archivist, well, what is an Archive?**

An archive is a place where historically valuable records are kept and preserved. Archives can be many different places – religious communities, historical societies, businesses and government. Business archives are usually proprietary, meaning that they are open primarily for employee use and outside researchers have to gain permission to access them. Government archives, on the other hand, are funded by tax dollars and belong to the public.

### **So, then what kind of archives does Sandia have?**

Well, Sandia is a GOCO - a government-owned, contractor operated, multiprogram laboratory operated for the Department of Energy (DOE) by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation. The records produced by Sandia for the Department of Energy are funded by government dollars and are, therefore, government records. Sandia's archives and any institutional archive for that matter preserves the materials that reflect the institution's corporate memory and these can take many different forms. Typically, employees donate project papers and photos that were most meaningful to them in their work. But, other items can be more unique. I recently acquired a splintery board retrieved from an old building torn down in 1994. Folks were amused when I accepted this piece, but as it turned out, this donation was very timely for a new exhibit I just completed, called, "Birth of a Laboratory." This splintery board was a real attention grabber and went along side an aerial photo showing the building's location in 1946. This board may have meant something to the person who retrieved it; perhaps she worked there for many years or knew it was representative of Sandia's early buildings.

### **[Vugraph #1: *Birth of a Laboratory Exhibit.*]**

November 1, 1999 is Sandia's 50<sup>th</sup> Anniversary and I plan to use many archive materials this year to help commemorate the event. It's clear that archive materials can tell us much about a company and its culture at any given time; something like a brochure from 1952 can give us a picture of what was important to the company at that time. Thanks to some people who are natural records managers and know exactly what to keep and to the pack rats out there, our archive collections help us to chronicle Sandia's history and institutional culture.



# 1

**To begin this discussion, I'll start by defining institutional culture.**

Institutional culture can be defined as the beliefs, practices, and artifacts shared by members of an institution. Widely accepted beliefs and practices bring a sense of continuity to the employees and help them to value their work as a part of the larger institution. They better understand why things are done a certain way and this knowledge helps when practices are changed or new practices are implemented.

**Hagengruber's views as a transition into Sandia's institutional culture.**

In recent years there has been increasing interest in preserving Sandia's institutional memory. An oral history program, called the Knowledge Preservation Project, was started in 1994 with the purpose of recording on tape the knowledge, experience, and ideas of key nuclear weapon design engineers. In 1997 Sandia's History Program completed a general history called, *Sandia National Laboratories: A History of Exceptional Service in the National Interest*. And this last September, Sandia Senior VP Roger Hagengruber's views on Sandia's legacy appeared in a *Lab News* article. Hagengruber commented that each Sandian, when they are at their best, comes to believe that they are the institution. They come to understand he says, that Sandia "is only as good as we are. No better. No worse." Laboratories like all institutions do have character. It is these characteristics that contribute to how employees and outsiders view an institution and may even determine whether or not they think it is a good place to work.

**Ways of looking at Sandia's institutional culture.**

Basic characteristics and beliefs of an organization help to form the heart of its institutional culture. Sandia has its own unique set of characteristics. First, Sandia is an engineering laboratory that grew out of the post WWII environment. Sandia's mission has always been nuclear weapons design and control. This work is done in an atmosphere of security where the employees have clearances, wear badges, and work in secure areas. Second, as the company grew it developed its own practices and artifacts. For example, Sandia inherited from Los Alamos a first-name informality. This practice has remained; most technical staff members at Sandia have Ph.Ds but they are not called "Dr."; they are called by their first name. There are many artifacts or symbols of its institutional culture, including test certificates; a company motto; flagship administration building; company newspaper; and social club. Third, as in most institutions, Sandia's greatest resource is its people. They are, in fact, the institution. Sandia's population includes engineers, scientists, field testers, and technical and administrative support staff. Our workforce has changed in age, education, women's roles, and diversity. Our technical staff believes they apply a can-do, problem solving approach to their work. Fourth, or finally, Sandia's has applied its technical expertise to other areas, becoming a multiprogram laboratory.

**Sandia's Work.**

So on to Sandia's work. Sandia is an engineering laboratory with the primary mission of design of nuclear weapon components and subsystems other than the high explosives. Traditionally, Sandia "weaponized" the nuclear systems designed at its partner laboratories, Los Alamos and Lawrence Livermore National Labs. Sandia is a part of the overall weapons complex and oversees a weapon from initial design, production and maintenance to final disassembly. In the post-cold war years, no new weapons have been designed and so Sandia's responsibilities have evolved to include stewardship of the nuclear weapons stockpile.

Sandia employs 8,300 people at sites in Albuquerque, New Mexico, Livermore, California; Tonopah Test Range, Nevada; and Kauai Test Facility, Hawaii. Of the 8300 Sandia employees, approximately 40% are employed as engineers or scientists.

**[Vugraph #2: Sandia today.]**

**Now, on to how Sandia began.**

Sandia's roots go back more than fifty years to the Manhattan Project in Los Alamos. The Manhattan project was formed in 1942 to develop an atomic bomb. With 100 of the best and brightest scientists and engineers and under the leadership of J. Robert Oppenheimer, the United States and Great Britain pooled their scientific knowledge and worked around the clock. With the detonation of the first atomic device at the Trinity site near Alamogordo, NM on July 16, 1945, they had achieved their goal. Right after the war, Oppenheimer sent a delegation to Albuquerque to form Z Division of Los Alamos. So, then, the first employees of Z Division, forerunner to Sandia Corporation, were born of this total dedication to the war effort; they were just released from the military, very patriotic and used to working long hours. They were young, just barely out of college or not even finished with their bachelor's degree; many had been called into military duty because of their specific areas of expertise.

**[Vugraph #3: Z Division].**

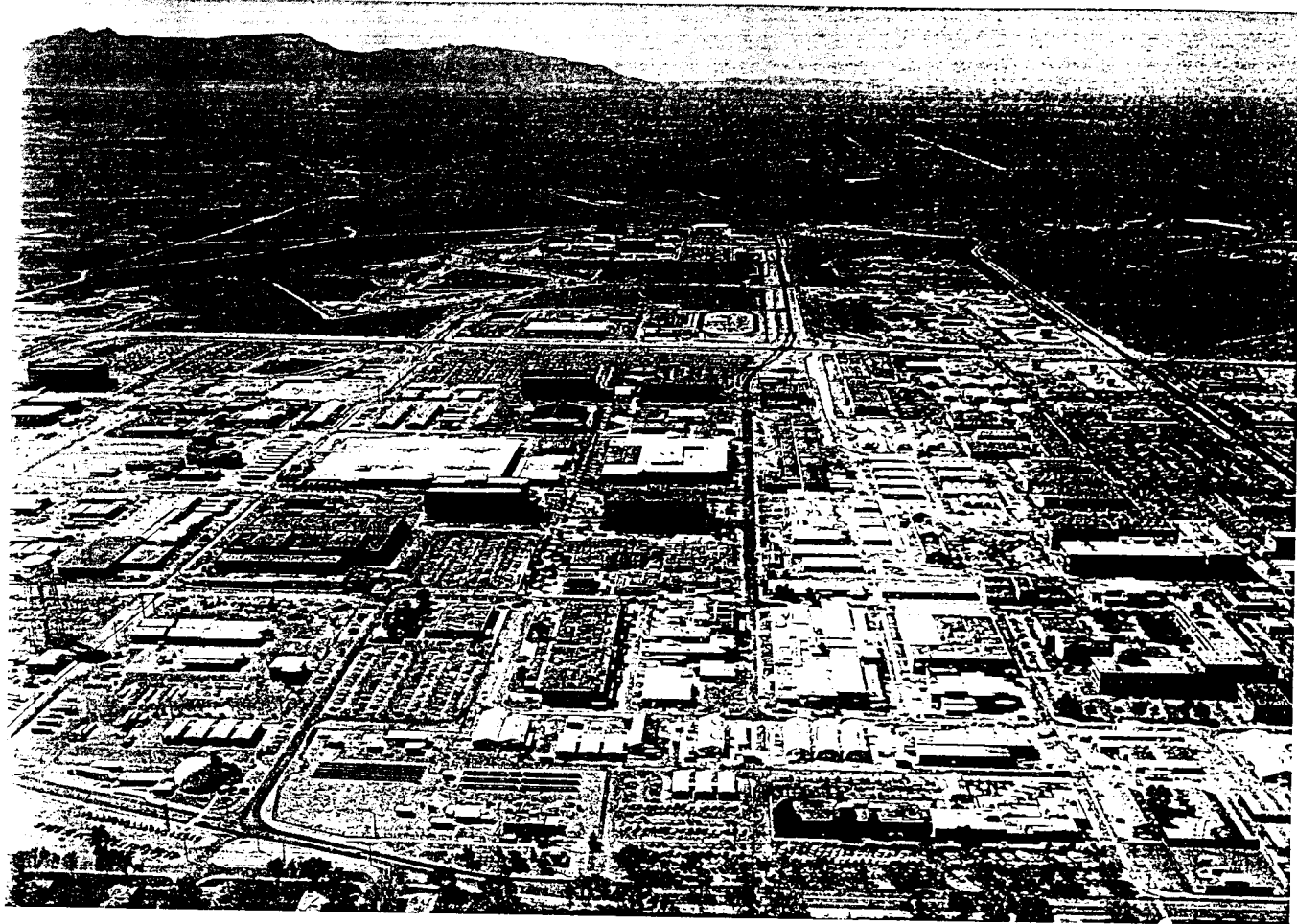
These first arrivals at Sandia Base found conditions far from ideal. The base was made up of a motley assortment of wood-frame structures. Similar to Los Alamos, security at Sandia was of utmost importance. Wooden guard towers were interspersed throughout the area and night search lights illuminated the fenced-in Technical Area.

**[Vugraph #4: Guard tower.]**

It was in this guarded, post-war environment that Sandia began. In this brief video excerpt that follows, Robert W. Henderson, a retired executive Vice President who was very involved in the Manhattan Project, recalls when he was assigned to Z Division at Sandia Base.

**[Video #1: Bob Henderson, SAND95-0002.]**

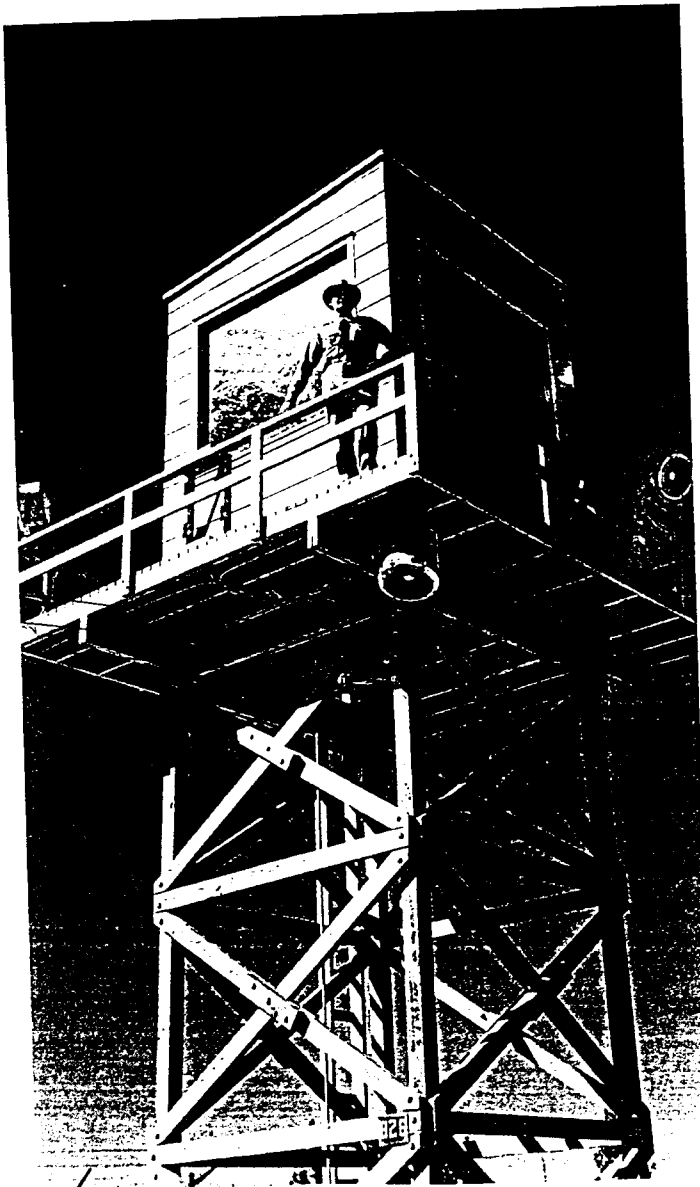
Prologue



#2



#3



#4

The mission of Z Division was the assembly of a stockpile of the Fat Man bomb that had been developed at Los Alamos and the development and testing of new models.

**[Vugraph #5: Fat Man].**

One retiree, an aeronautical engineer, from those early days said the Fat Man was the work of a physicist and wasn't very aerodynamic, so his first assignment was to improve its design. A testing program was formed and a test range established at the Salton Sea Test Base in Southern California. In 1946, Z-Division personnel were called to the Pacific to support the first postwar nuclear test series, Operation Crossroads.

**[Vugraph #6: Crossroads Test.]**

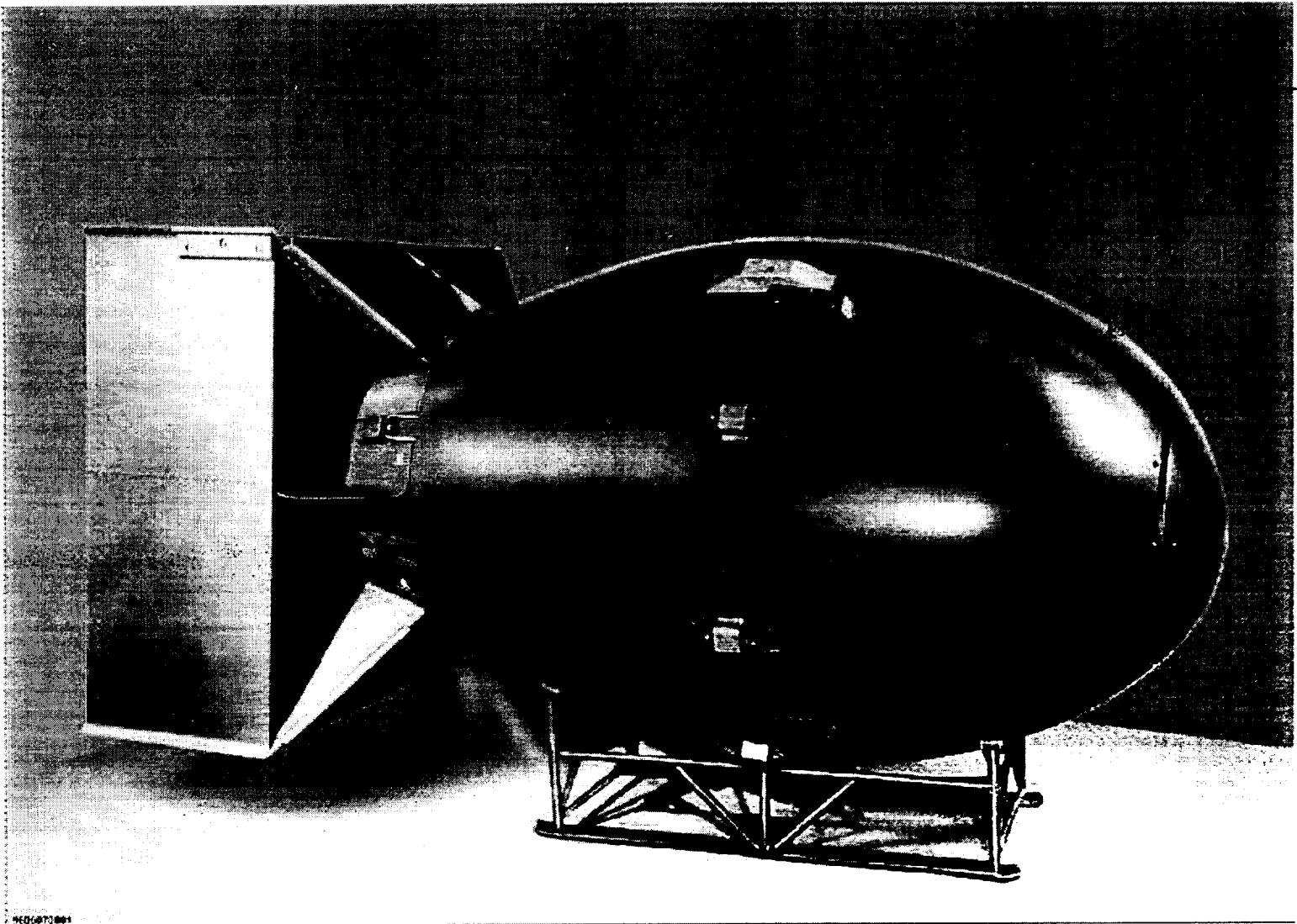
When asked about his work at Crossroads, Howard Austin, now retired, said the conditions were deplorable – with water that tasted like kerosene and food when the military dropped crates of canned food in the ocean near the island – but, in spite of this, the work was exciting and fun. This early testing was the roots of the field test culture that developed at Sandia. Field test personnel had to figure out the best way to get things done. They worked closely together often at remote sites and, as a result, developed a real sense of camaraderie. As a spin off from the military's practice of certificates and patches, they created their own certificates that fostered their identity with a project or test. Here's a couple of examples of certificates issued to Sandia retiree, Ben Benjamin. The first is an early certificate commemorating Ben's service at the Salton Sea Test Base. The second is a later, more fancy certificate.

**[Vugraphs #7 & 8: Test Certificates.]**

The area around the Salton Sea Test Base became heavily populated and Sandia's requirements for sea-level air drops changed; so in 1957, the Tonopah Test Range, in south-central Nevada was added and became Sandia's permanent range in 1960. Sandia did as many as a thousand weapon development tests a year during the 1960s, but improvements and economies in testing reduced the annual number by more than half in the 1970s. Although hard on families because of the travel, many found field test to be satisfying work. This interview with Howard Austin relates some of what he worked on during his career; it includes two different bits.

**[Video #2: Howard Austin, SAND94-2887.]**

Now, because no new weapons are being designed, the field test function at Tonopah has changed to a campaign-style program - meaning that employees are sent, on an as needed basis, to support specific stockpile evaluation tests. As a result, the field test culture at Sandia has dwindled. Some tests are simulated on the computer, but there continues to be a field test mentality among those Sandians who believe that computer simulations don't compare to the real thing.



Vu graph # 5



Vugraph #6

# CERTIFICATE OF SUITABILITY

## THE FIELD TESTING ORGANIZATION OF THE SANDIA CORPORATION

CERTIFIES THAT Ben C. Benjamin HAS SUCCESS-  
FULLY SURVIVED A TOUR OF THE SALTON SEA TEST BASE  
AND HAS PROVEN HIS SUITABILITY TO;

ADEQUATELY COMPENSATE FOR HIGH TEMP-  
ERATURE AND HUMIDITY, RESIST EROSION BY  
SAND, CORROSION BY SALT SPRAY, AVOID  
AND/OR RESIST THE RAVAGES OF:

SIDE WINDERS  
SCORPIONS  
TARANTULAS  
AND OTHER FORMS OF WILD LIFE.

HORSE FLIES  
CRICKETS  
CENTIPEDES  
AND OTHER FORMS OF WILD LIFE.

IN WITNESS OF HIS ABILITY TO MEET THE SCFTO SPECI-  
FICATIONS FOR FIELD SUITABILITY WE HERETO FIX OUR HAND  
AND SEAL ON THIS 1st DAY OF August IN THE  
YEAR OF 1952.

*Howard B. Austin*  
CHIEF OF THE TEST  
*W. H. [unclear]*  
RECORDS OF THE TEST  
*Blaine [unclear]*  
MOST HIGHEST CHECKER OF RESULTS



QUANTUM MUTATIS AB ILLO

Vugraph #7

This is to Certify that  
Participated in Project  
**Rio Blanco**



Ugraph #8

### **A Laboratory of its own.**

In 1948, Z Division became known as Sandia Laboratory, Branch of Los Alamos Scientific Laboratory. However, it became clear that the University of California no longer wanted to manage Sandia because of Sandia's rapid expansion and weapons production function. After much consideration and the determination that Sandia would best be managed by an industrial contractor, President Harry Truman appealed to AT&T's patriotism by stating, "In my opinion," he said, "you have here an opportunity to render an exceptional service in the national interest." It is interesting to note that this phrase "exceptional service in the national interest" has been adopted by Sandia as its own; it has become a part of our institutional culture in that this phrase is used over and over to describe our work. AT&T subsidiary Western Electric did accept management of Sandia and on November 1, 1949, Sandia became its own Laboratory. The first president of Sandia Corporation was George Landry, a production expert.

### **Sandia's rapid growth and development of a company culture.**

During Landry's period as president, Sandia grew rapidly, from 1,740 employees in 1949 to 4,000 by 1952 and became New Mexico's largest employer. The culture changed from being a small, close-knit group to a rapidly expanding work force. Along with the rapid growth, employees were faced with much greater structure imposed by Landry's go-by-the-book management style and this was not well received. In one case, Landry attempted to reduce the generous vacation time inherited from Los Alamos and organizers used this as a rallying cry. Within months Landry conceded to negotiations with three unions. When Landry arrived in 1949, Sandia was in the throes of new construction. This is an early photo of Sandia's administration building, Building 800 with old cars in front.

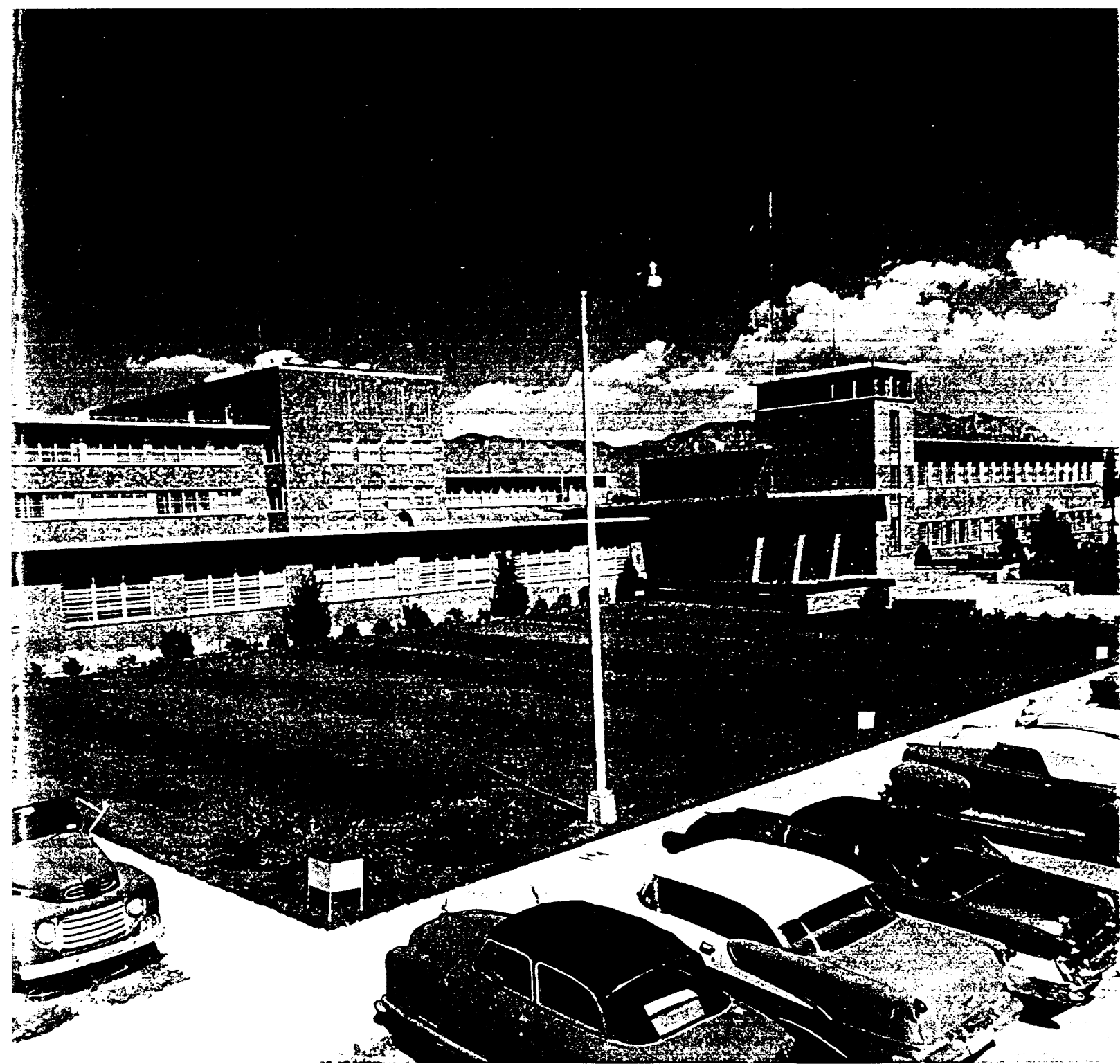
#### **[Vugraph #9: Building 800.]**

Although remodeled, this building looks much the same and remains Sandia's main administration building. This building has become representative of Sandia; videos and advertisements often include a photograph of Building 800. Sandians and others associate it with the company's key functions – Sandia's President and controller have always been housed in this building.

Sandia's growth was also reflected by the development of the company newspaper. In 1948 the *Sandia Bulletin* was established. The mimeographed newsletter featured cartoons by Felix Padilla and reflected the values of the day. Show cover art and humor.

#### **[Vugraph #10: *Sandia Bulletin*.]**

The newsletter contained department gossip and announcements about the many clubs and social functions. The *Sandia Bulletin* eventually became today's *Lab News*, which has been circulated in house every other Friday since 1951. As a company newspaper, it deals with the challenge of writing about the company's product when the product is highly classified. In the earliest years, the paper was long on news of employees' activities in the community, hobby stories, Coronado Club stories, and short on the "hard



Vugraph #9

# SANDIA WEEKLY BULLETIN



news” of weapon programs. By the 1970s and the Lab president’s state-of-the-Labs interview, the *Lab News* became more open with articles on weapons, field tests, research, and other weapon related activities. As the years went on, the paper came to cover more technical programs and much fewer personal interest stories. The *Lab News* has provided continuity to the company; it’s been around from the earliest years and has become part of Sandia’s institutional culture. Sandians expect to see the paper every other week and expect that it will let them know what they need to know about what’s going on around the Laboratory.

In 1950 the Coronado Club was established. This was truly a social center for employees and came to be identified as part of the institution. Sandia was miles away from Albuquerque then; most of the people working on the base also lived on base. The men and women lived in separate barracks with house mothers, and families lived in base housing. Although people worked together all day, their families spent their leisure time together, as well, in various activities at the Coronado Club; in sporting activities – there were many bowling and basketball leagues and women’s and teens clubs. One Sandia retiree said the Coronado Club was an oasis then since Sandia was so isolated from the rest of Albuquerque.

**[Vugraph #11: Coronado Club.]**

As Albuquerque has grown, the Coronado Club has ceased to be the center of activities. Although many Sandians still belong to the Coronado Club, Sandians are primarily members of the greater Albuquerque community.

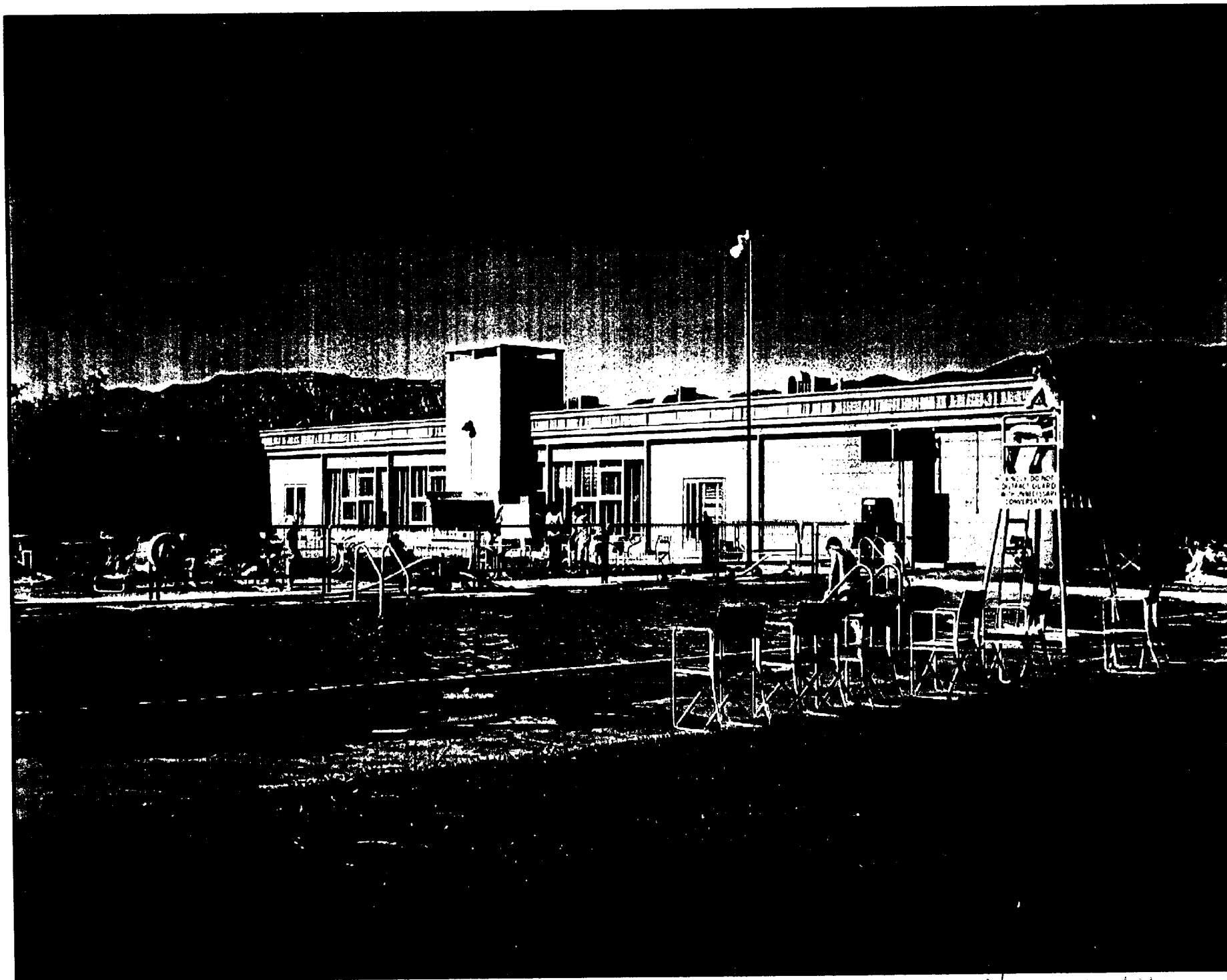
The roles of the men and women were a reflection of the greater society. Most of the leadership was male and anglo; women were usually hired into clerical positions or assembly line operations.

**[Vugraph #12: Women on the assembly line.]**

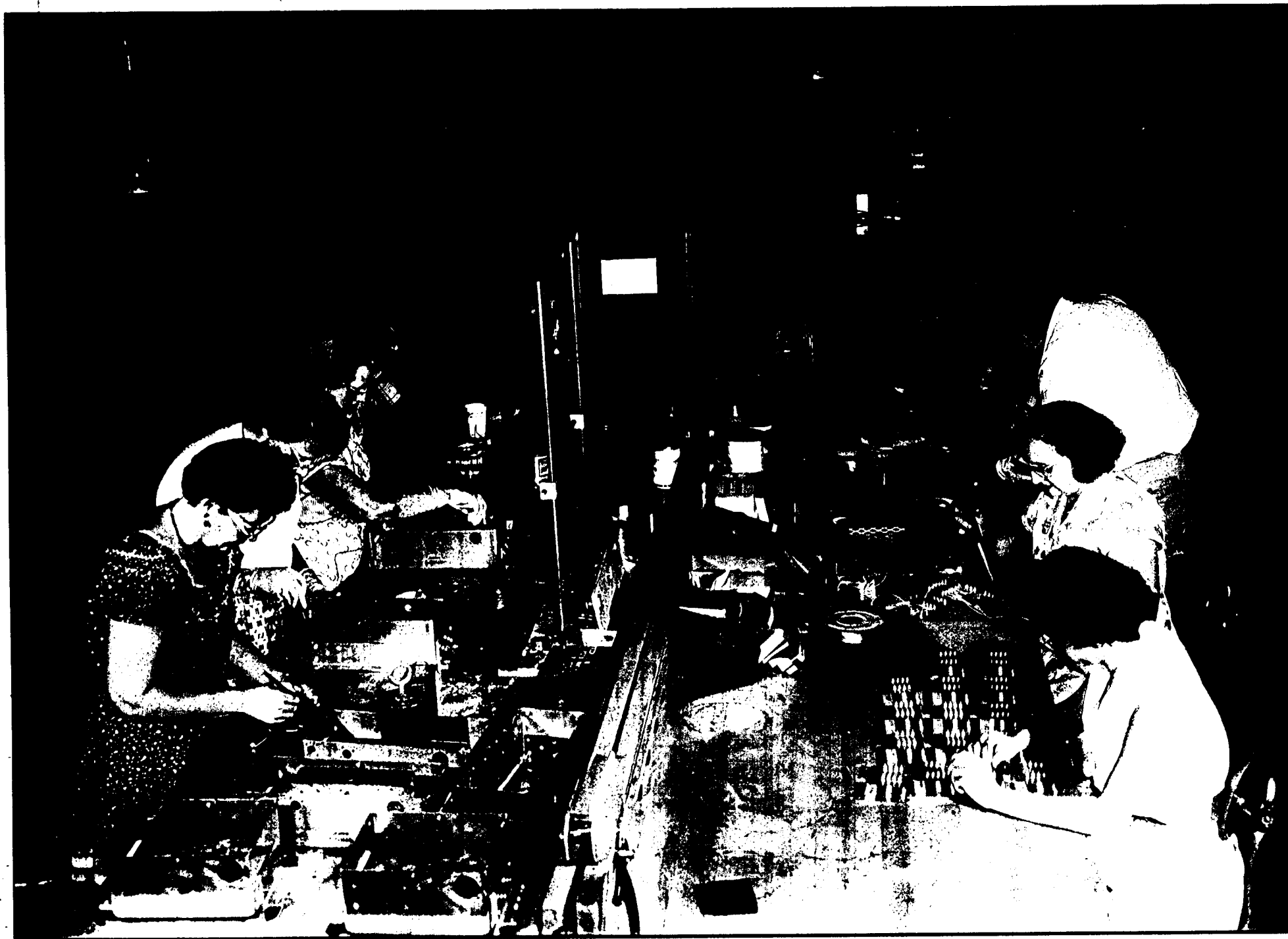
By the 1950s, there were a few women scientists, though, and a female doctor. This lack of women in technical fields was a reflection of society in general; women in these fields simply were not out there to be hired. This situation has improved. I’m going to show you a video excerpt of an interview of Kathleen McCaughey, who is currently a Director of Production Engineering at Sandia. She started at Sandia in 1970s as a student intern, was later hired as a bachelor-level engineer and went back to school on the OYOC Program - One Year On Campus - to obtain her master’s degree; at one point in her career, Kathleen was the manager of the Tonopah Test Range.

**[Video #3: Kathleen McCaughey.]**

As I mentioned, Kathleen McCaughey took advantage of a Sandia program to obtain her master’s degree. In the 1950s the educational standard in the engineering community was a bachelor’s degree, but by the end of the decade, the nature of Sandia’s work required the engineers to have more detailed instruction in some areas. The Technical Development Program was developed at Sandia and recruits with bachelor’s degrees in electrical or mechanical engineering were sent to UNM for two years while working part



Vugraph #11



Vu graph #12

time at Sandia. This program and others promoted a better-educated work force. This chart will give you an idea of the number of higher degrees today as opposed to Sandia's early years.

**[Vugraph #13: Chart showing educational comparisons.]**

A well-educated work force has become the standard at Sandia and most institutions today.

**Now, on to Sandia's Work –Weapon Development.**

Right after WWII - with the beginnings of the cold war because of increasing tensions with the Soviet Union - Z Division personnel went to work right away on development of a stockpile. As I mentioned earlier, they began field testing the Fat Man bomb at Operation Crossroads in the Pacific. In August 1949, the Soviet Union detonated its first nuclear device; and the Korean War began in 1950. As a result, Sandia engineers were challenged to begin work on emergency capability weapons for the war reserve. In line with Eisenhower's policy of massive retaliation, Sandia began work on 22 new bomb programs during 1953 through 1961 although some of these did not make it to the stockpile. When electrical engineer Bob Peurifoy joined Sandia during the Korean War, he found work proceeding on a six-days-a-week schedule under intense, secretive conditions in the face of what seemed to be Communist threats. He noted that even the telephone book was classified. "There was an immediacy, an urgency, with regard to doing everything possible to be responsive to national policy in growth of the stockpile and variety of weapon types," Peurifoy recalled. "Cost was of little consequence". He worked on the development of the wooden bomb concept. The military wanted to reduce the need for continually testing and monitoring nuclear weapons. A wooden bomb could lie inert like a log year after year, but could be pulled from the stockpile and used at a moment's notice. This video clip is from an interview of Bob Peurifoy and gives you his views on the development of the wooden bomb. Peurifoy retired in 1991 after 39 years; his last position was as Vice President of technical support.

**[Video #4: Bob Peurifoy, SAND94-2888.]**

Another Sandian, Randy Maydew, is a retired aeronautical engineer who was involved in the development of the laydown bomb. In the mid-1950s, the Air Force and Navy required a bomb that could fall to the ground and await escape of delivery aircraft before exploding. Maydew and others formed an aerodynamics department and conducted substantial research and testing, including building a wind tunnel to test scale models at transonic speeds. They also developed new parachute materials that were sufficiently strong to slow bomb descent. Sandia became a leader in parachute technology. Here's a short clip of Randy Maydew who talks about the lay down concept and Sandia's parachute work. Maydew also worked at Sandia for 39 years and was chief of aerodynamics for 23 years, responsible for the aerodynamic design of nuclear weapons, rockets, and parachutes.

**[Video #5: Randy Maydew, SAND94-2889.]**

## **Degree Levels at Sandia National Laboratories**

**In 1962:**

<u>Ph.D.s</u>	<u>Master's degrees</u>	<u>Bachelor's degrees</u>
136	598	1,805

**In 1996:**

<u>Ph.D.s</u>	<u>Master's degrees</u>	<u>Bachelor's degrees</u>
1,445	2,215	1,001

Both engineers, Maydew and Peurifoy, were challenged to work on new developments; Peurifoy's work on the development of the wooden bomb and Maydew's parachute work are good examples of our technical staff's applying the problem solving, can-do approach to get the job done.

### **Fundamental Research.**

In 1956, Sandia technical staff campaigned to expand Sandia's work in fundamental research. To formulate a plan for this research effort, Glenn Fowler, Vice President of Research, organized a "Four O'Clock Group" that met every day at 4:00 p.m. to brainstorm ideas for the establishment of a fundamental research program. The group formulated a plan, approached management, and gained approval for a fundamental research program at Sandia. Eventually Sandia recruited nationwide to add a second generation of engineers and scientists to contribute to the science and technology base undergirding engineering at Sandia.

### **Clean Room.**

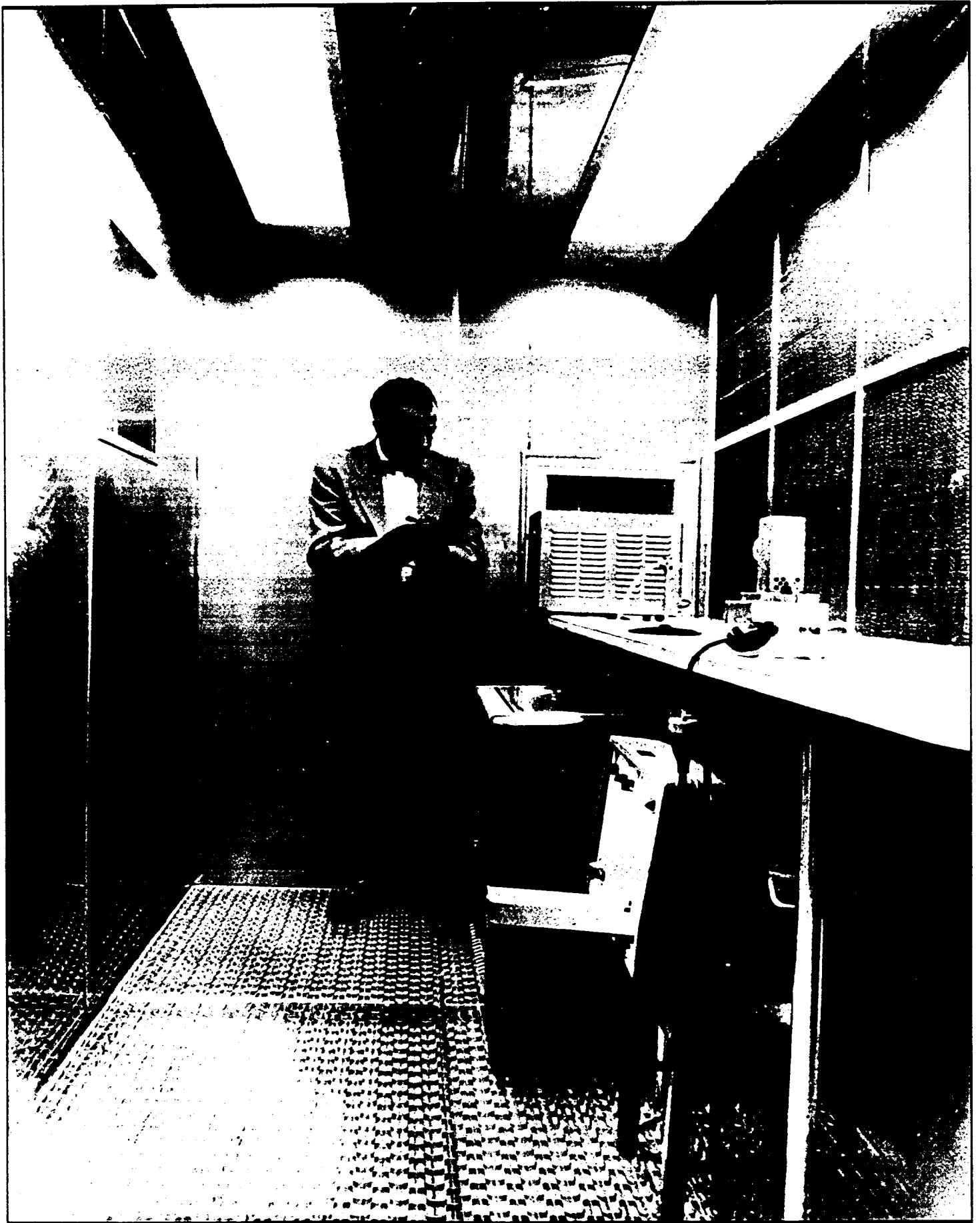
Sandia scientists worked alongside engineers to improve processes. The 1960 development of the laminar air flow clean room by Sandia physicist, Willis Whitfield, is worth mentioning here. As weapons became smaller, lighter, and faster there was a need for particle-free manufacture for production of close-tolerance parts. The laminar airflow clean room used a uniform flow of filtered air from the ceiling to floor grates, or wall to wall, to remove dust from the air. Filters in the air stream not only stopped dust, they removed bacteria and fungi as well. Whitfield's invention proved to be revolutionary - improving on the air quality of existing clean rooms by thousands of times and has been credited with making the modern microelectronics industry possible. In addition to the microelectronics industry, clean rooms are used in the space program, hospitals, and food processing. Whitfield's invention belonged to the Atomic Energy Commission, the precursor to today's Department of Energy, and so the technology was owned by the government and released to the public. Whitfield never saw any personal gain from his invention; however, I have met him and he has a great deal of personal satisfaction that his invention has been so beneficial to society.

**[Vugraph #14: Clean room.]**

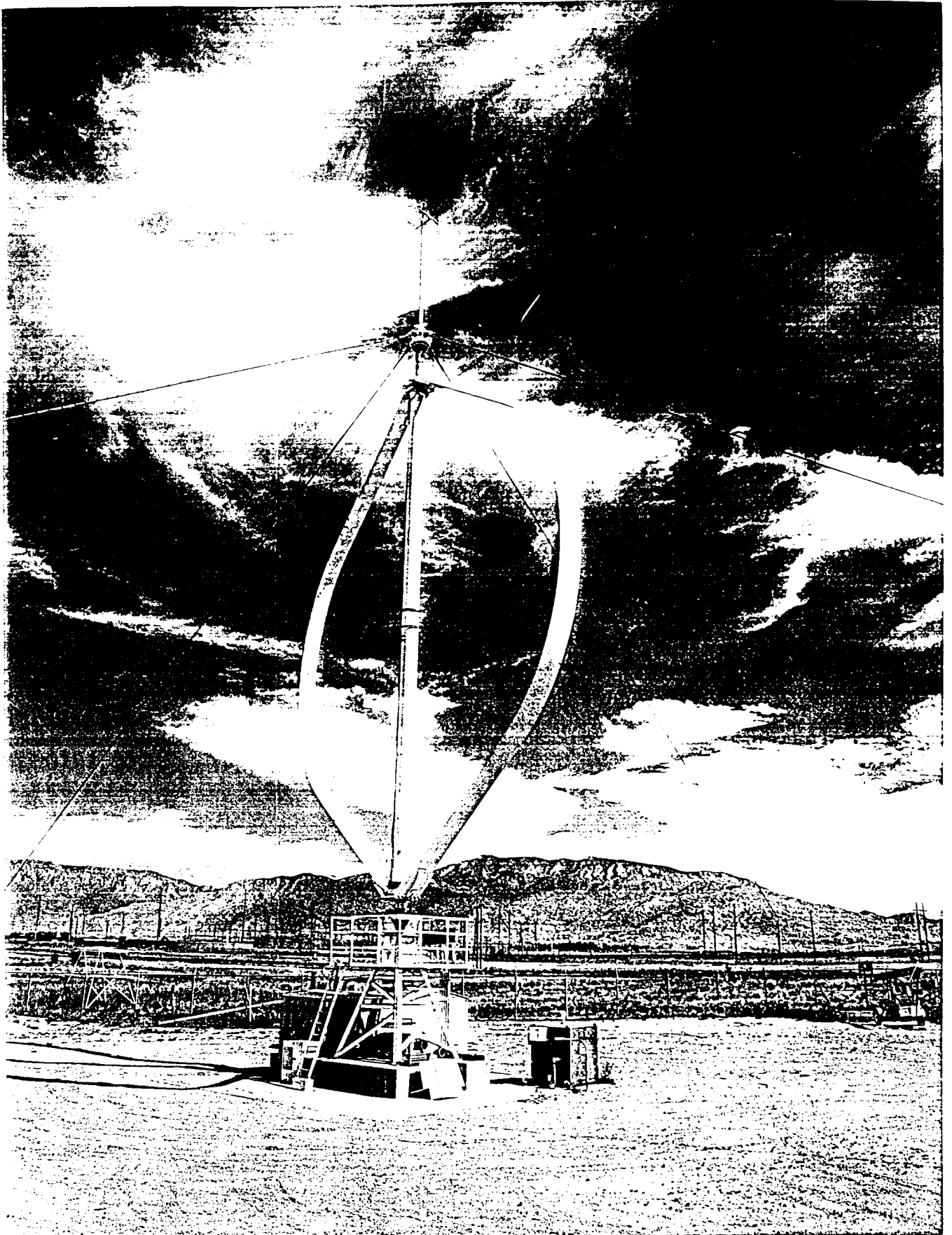
### **Energy Crisis.**

Following a similar approach to the "Four O' Clock Group" that met daily in the 1950s, in the early 1970s during the nation's energy crises, Don Shuster and others met daily in late 1972 and 1973 to solicit ideas and proposals for energy research. Several initiatives were approved and Sandia engineers applied their expertise to new areas in solar energy, wind energy, and other areas. Randy Maydew, the aeronautical engineer you saw on the video earlier, used his expertise to work on one alternative energy source, the Vertical Axis Wind Turbine. Research was conducted to improve the wind turbine's aerodynamic efficiency and eventually a highly reliable, low-cost turbine was transferred to industry with its use in commercial wind farms in California.

**[Vugraph #15: Vertical Axis Wind Turbine.]**



Vuegraph #14



#15

**Multiprogram Laboratory.**

Research activities and, later, energy initiatives brought flexibility to the Laboratory and contributed to Sandia being named a multiprogram laboratory in 1975. Some Sandians felt these diversification efforts were unimportant in the face of Sandia's primary mission. This has in some ways, though, fostered a healthy competition in technological developments and has allowed collaboration between the different technology areas.

**Layoffs and downsizing.**

The early 1970s proved to be a painful period for Sandia. Congressional budget cuts brought about a ten-percent staff reduction in 1973. Although management thought it made layoff selections with an even hand, there was successful litigation against Sandia by former employees and the Department of Labor charging age discrimination. This period of time has been described as a soul searing experience. More recent funding cutbacks in 1995 and 1996 also mandated staffing reductions, but Sandia management, having learned from the earlier experience, asked for volunteers from all levels to leave the company to take Voluntary Separation Incentive Packages. This process seemed less traumatic, but funding cut backs have brought a sense of unease to the employees; employees don't take for granted 30-year careers anymore.

**Employees at their best**

When I first talked about institutional culture I talked about Roger Hagenruber's view that when an employee is at his or her best, they come to believe they are the institution. As the archivist, I come in contact with many employees as I collect materials. Recently, I met a young engineer who is the primary investigator for a cervical cancer probe that was developed elsewhere and brought to Sandia for improvements. His group applied its expertise in imaging and spectral analysis (used in Sandia's satellite and nonproliferation work) to improve the prototype to make it smaller and more cost effective. The technology was then returned to private industry where it was improved upon three-fold. What was interesting was the obvious enthusiasm this engineer had about his work. He commented that coming to work every day is like a dream come true; he gets paid for doing something he loves. This exemplifies an employee at his best. We're not in that place all the time; usually, an employee looking back on his/her career can select several projects where they were most satisfied with their work and what was accomplished.

**Sandia becoming more corporate.**

In recent years Sandia's leadership has brought new initiatives that have made Sandia more of a business or corporate environment. When the first homegrown president, Al Narath, came on in 1989, he had just returned from a stint at AT&T. He brought with him many new initiatives, saying, "We come from a culture where we always believed we knew best, we're moving into a culture where a significant fraction of our customers can take their business elsewhere – and will – unless they believe Sandia offers them a better deal." Sandia had to learn to compete in a broader market. Sandia restructured and a whole layer of management was eliminated. Quality initiatives were implemented and Sandia's top management that had been called the Small Staff for forty years was

renamed the Sandia Quality Leadership Council. This ushered in an era where we do strategic planning, and take corporate sponsored classes on team building, marketing, and personality styles, and conduct diversity training. Narath left Sandia when Lockheed Martin took over management of Sandia in 1995. Our current president is C. Paul Robinson.

As I conclude, I will refer again to Roger Hagengruber's comments that were recently included in a *Lab News* article. He says, "Sandia has a unique genetic code. In the "genes" that make up who we are, you'll find traces of the Manhattan Project. You'll find traces of Bell Labs. You'll find science genes, yes, but also lots of engineering genes, hands-on, problem solving genes." Hagengruber goes on to talk about how at Sandia there was always the 'one thing' about who we are – the Cold War or the energy crisis, for example. In the last few years, the 'one thing' hasn't been so sure. Roger suggests that as time goes by it will become more obvious that our vital core mission is still there.

Institutional culture is really how a company perceives itself. At Sandia's core is its mission in nuclear weapons design and control and stockpile stewardship. The workforce is a diverse population of men and women including engineers, field testers, scientists, and technical and administrative support. The technical staff prides themselves on a can-do, problem-solving approach in their work. Employees have clearances and work in restricted areas. Sandia has developed its own cultural artifacts, such as a company motto, newspaper, a social club, and flagship administration building. It has also gone through painful periods, such as layoffs and restructuring. Sandia has diversified its work, becoming a multiprogram laboratory that responds to national needs, such as the energy crisis of the 1970s and to industry by contributing its expertise to developments such as the cervical cancer probe. All of these things have contributed to Sandia's institutional culture that continues to evolve.